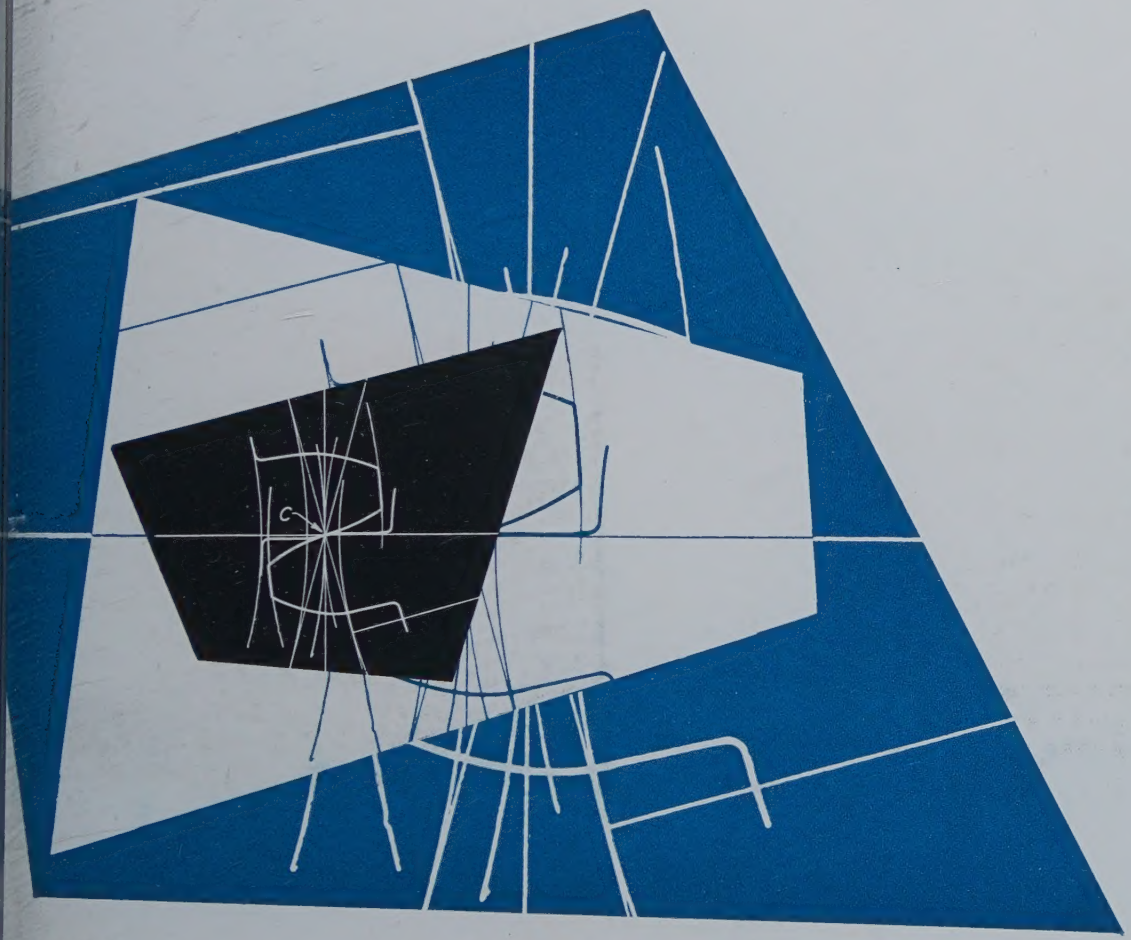
GRAPHIC SCIENCE



Reproduction Issue

MARCH 1961

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MARS

J.S. STAEDTLER, INC.
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GRAPHIC SCIENCE

THIS ISSUE: 12,200 COPIES

MARCH 1961

VOLUME 3 NUMBER 3

The Magazine of engineering drawing management, covering drafting, reproduction and microfilming, technical illustration, drawing standards and drawing filing in all industries.

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Letters

Help Needed

Sirs:

I want to thank you for adding our company to your list of subscribers. Your magazine has been helpful in many ways, and will help us to keep abreast in the future.

At this time we are in the process of writing Job Classifications for Draftsman, Layout Draftsmen and Designers. There seems to be so little information available on which to base these classifications. This can be a major problem, since it can lead to injustices in hiring workmen.

Since this problem has probably plaqued many Chief Draftsmen before me, it is quite possible they have compiled standards which would help me. If any of your readers have any material related to this subject or know where such information can be obtained, I would like to have them write me.

WILLIAM SMITH, JR.
Chief Draftsman
D. E. Makepeace Div.
Engelhard Industries, Inc.
Pine & Dunham Sts.
Attleboro, Mass.

Editor's Note: Readers having information for Mr. Smith might also want to contact the Editors, since information along this line should be published.

Blue Printers Object

Sirs:

I have just returned home to New York after attending the several regional blue print conferences throughout the United States. These meetings give us the opportunity to get first-hand knowledge of existing conditions throughout the reproduction industry. Repeatedly I heard from blue printers who were quite concerned about the statements printed in GRAPHIC SCIENCE in the article written by Mr. Fleming of Ford, Bacon, & Davis. It is unfortunate that certain people in their enthusiasm for some of the new and unproved reproduction processes tend to belittle and make inaccurate statements about products and services of our industry, namely blue printing and whiteprinting, that have been, and still are the main processes of reproduction that are used to communicate all graphic plans and ideas.

I am sure there must have been a typographical error when the article referred to 72 hours to get blue prints when 72 minutes would be more nearly accurate. I particularly take objection to the statement: "The blue prints tended to fade and to lose their clarity with repeated use," because this is contrary to fact.

If you, or some researcher on your staff, would take the time to go to the Building Department of the City of New York, or any other agency where prints are filed, I am sure that you will find blue prints that date back to 1920 and earlier. I am sure that you will find these blue prints are in good readable condition today.

The commercial reproduction industry is not opposed to progress. Certainly, we cannot allow statements as contained in this article to go by unchallenged. In fairness to our industry your magazine should run a correction on this story indicating that reference to 72 hours to be incorrect and that blue prints do not fade.

VINCENT T. COONEY
President
International Association of
Blue Print and Allied Industries
33 E. Congress Pkwy.
Chicago 5, Ill.

Sirs:

Your magazine, GRAPHIC SCIENCE, has published some excellent articles since I have been reading it. However, as a commercial blue printer, I must take exception to the article "Microfilm System Solves Engineering Record-keeping Problems" in your October issue.

The system may be working out well for Ford, Bacon & Davis, but not for the reasons given in the article. You state that one reason blue prints were being replaced by microfilm is: "The blueprints tended to fade, and to lose their clarity with repeated use." This must have been some type of print other than a blue print, perhaps an intermediate of some type, as a blue print not only has remarkable keeping qualities, but can be rejuvenated by a commercial blue printer. Not only that, a blue print will last much longer than the type of print they are making from a microfilm as described in the article.

Mr. Fleming also states that his draftsmen now have a print in a matter of seconds. "Previously it took as long as 72 hours." The inference that it would take this long to get a blue print from a commercial source is grossly unfair. Many of my friends in the blue print business in New York are used to picking up customers' drawings, printing them, and returning them in less than 72 minutes. I never heard of a blue print job, no matter how large, taking as long as 72 hours to print.

Mr. Fleming is also enthused about the economy of his method. He gives away his costing method by which he makes copies for from one-fifth to one-half less than that charged by commercial sources; in the last sentence in the article, "Furthermore, the cost of installing the entire system, exclusive of our own labor charges, was less than our warehouse rental for two years." The phrase "exclusive of our own labor charges" will make any system look good. His own labor must be charged to something, why not the project for which it is being used?

Some day, I would like to see your magazine print a report of the many companies who have found that making their own prints proved uneconomical and reverted to the use of a commercial blue printer. If you are interested in some case histories, I will be happy to give them to you.

MAURICE V. O'CONNOR
President
O'Connor Blue Print Co.
184 W. Washington St.
Chicago 2, Ill.

(Letters to the editor should be addressed to GRAPHIC SCIENCE, *Wilton, Connecticut. Names will be withheld upon request but all must be signed.)*

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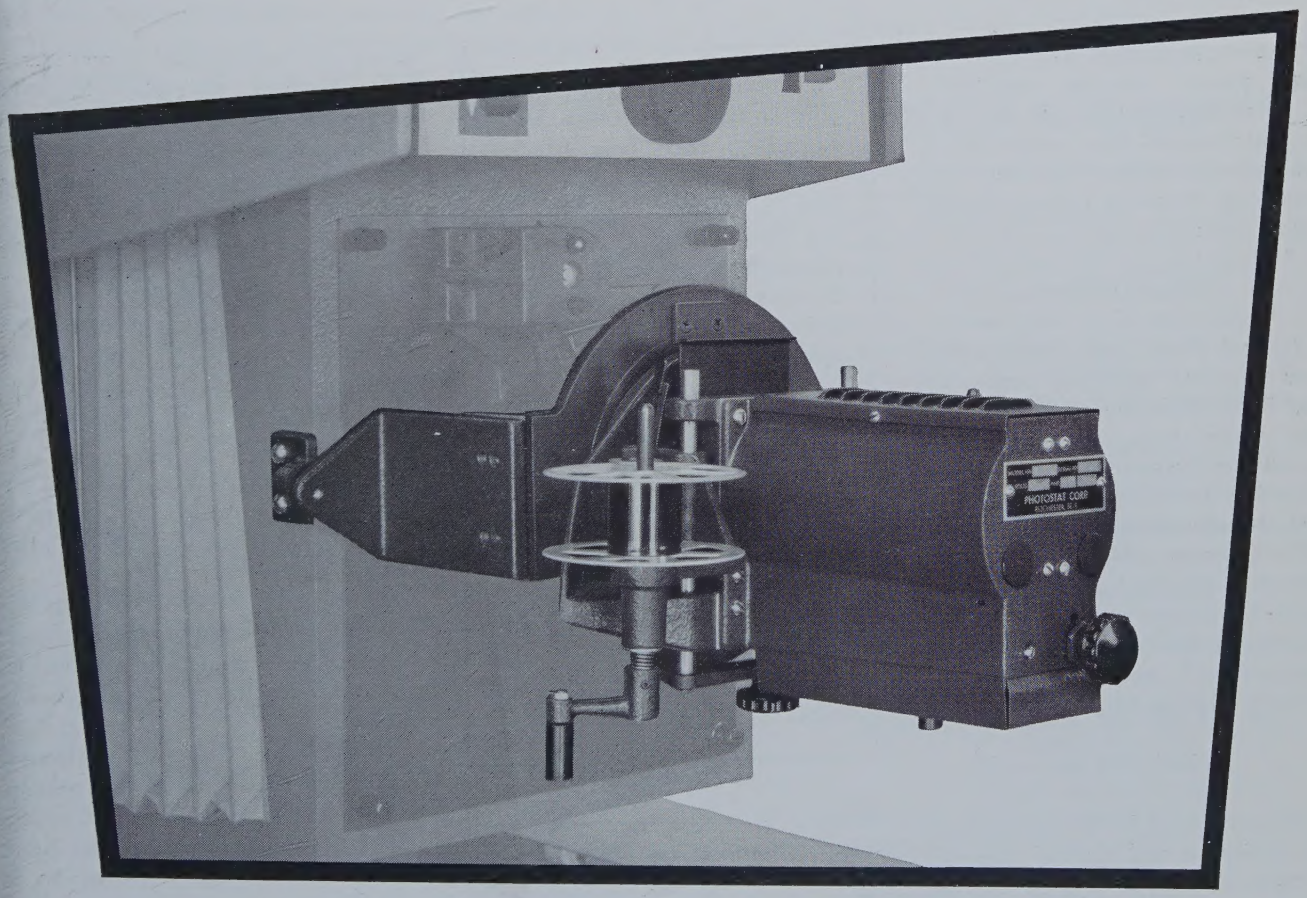

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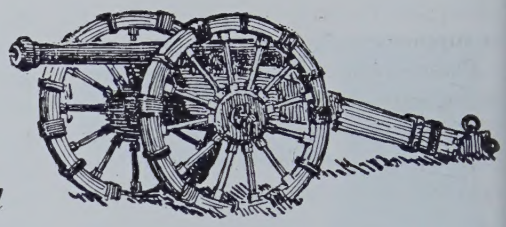

Military Engineering Documentation

by W. S. Hutchinson

New Standards Approved

SEVERAL military documents approved recently established unified practices for the military services and their contractors in the areas of optics, lubrication and electronics. Below is a short accounting of each:

MIL-STD-1241

Optical Terms and Definitions: A new standard approved September 30, 1960 establishes definitions for the words, terms and expressions peculiar to the general field of optics. Excluded are photographic, physiological and opthalmic optical terms. ASA proposes adoption as a Y18 American Standard. In recent years optics has gained new importance for tracking missiles and satellites. This standard will assist in interpreting military applications uniformly.

MIL-STD-34

Preparation of Drawings for Optical Elements and Optical Systems, General Requirements For: A new standard approved November 3, 1960 describes the special drafting practices to be used in the preparation of drawings for optical elements, components and systems. General requirements cover types of drawings, drawing format, dimensioning and toleranancing, orientation, standard notes, materials block, etc. Detailed requirements include, lenses, prisms, wedges, reticles, windows and filters, mirrors, cemented assemblies, etc. Sample drawings are illustrated for optical elements, components and systems, including schematics. As the first standard of national scope to be developed for optical drawings, MIL-STD-34 brings to the military and industry alike, dollar benefits for new design and production through uniform interpretation.

AN INVITATION by the National Microfilm Association to participate in the 1961 National Microfilm Contion has been accepted by the Department of Defense. Speakers will tell of "Microfilm's Place in DoD Engineering Data Systems," and also "Microfilm System for Missiles." A military panel representing the Army, Navy and Air Force will discuss "DoD EDMS at Work." EDMS means "Engineering Data Micro-Reproduction System." The DoD session will be held on the morning of April 5th, Hotel Sherman, Chicago. (See page 10 of this issue for further information on the National Microfilm Convention.)

MIL-STD-33

Lubrication Instructions, Preparation and Presentation of: A new standard approved November 2, 1960 covers the general and detailed requirements for the lubrication and other servicing points, lubricants, and procedures for periodic lubrication of all military equipment. The published instructions may be designated as lubrication order, lubrication chart, lubrication diagram, or by any other title deemed appropriate by the responsible department or service. The standard applies to all lubrication instructions prepared by or for the military departments or services. Definitions are provided for accurate means of reference, but are not mandatory, of the following terms:

Lubrication Section—That section or chapter of the appropriate manual covering the complete lubrication instructions for the end item or component.

Lubrication Order—A separately published, concise document containing condensed lubrication instructions and prescribing lubricants and lubrication intervals, and intended to be attached to or carried with the equipment.

Lubrication Manual—A separate manual covering the lubrication of the end item in detail and should be used to provide lubrication instructions for large or complex equipment.

Lubrication Chart—A card-type instruction prescribing all lubrication intervals, lubricants, and the necessary instructions for their application. A lubrication chart may consist of one

or more cards and should be used for items that do not require detailed instructions.

Decalcomania—A lubrication chart in the form of a decalcomania. Lubrication instructions may be presented in the form of a decalcomania for items that are of such size or that by intended use render the other forms of instructions impracticable. An example of this item would be a portable generator. Decalcomanias may also be used to supplement the other forms of lubrication instructions.

Plates—Plastic or metal plates containing specific lubrication instructions permanently fastened to the equipment. The standard prescribes approved intervals and symbols, plus sample format illustrations for lubrication charts, manuals and notes.

MIL-STD-275A

Printed Wiring for Electronic Equipment: A new coordinated standard (superseding MIL-STD-275 [SHIPS]) approved September 7, 1960 establishes design principles governing the fabrication of formed-in-place electronic equipment wiring referred to as printed, prefabricated or processed wiring. The requirements do not apply to the fabrication of parts, such as resistors, inductors, capacitors or transmission lines fabricated using these techniques, but do apply to the mounting of such parts on printed wiring boards.

Master Drawing for printed wiring is explained, using terms as set forth in MIL-STD-429. Master drawing establishes the size and shape of the printed wiring board, the size and location of all holes therein, and the shape or arrangement of both conductor and non-conductor patterns or elements, with separate views of each side of double faced boards. In dimensioning all locations on a master drawing, a modular grid system is employed. The basic modular units of length are 0.100″, 0.050″ or 0.025″ in that order of preference. The basic unit is applied to the X and Y axes of the Cartesian coordinates. All locations are dimensioned or indicated by means of a grid intersection on the master drawing. This applies to the location of such things as holes, over-all printed wiring board dimensions, spacing or component-part leads and test point locations. All holes or other features are to be located within 0.007-inch radius of the true position indicated by the grid location. The over-all board dimensions (length and width) coincide, wherever practicable, with lines of the 0.100-inch grid.

The standard covers printed wiring boards having the following types of interfacial connections:

Type I—Clinched jumper wire
Type II—Eyelets or plated-through holes

and the following types of part attachment methods:

Type A—Eyelets with clinched leads
Type B—Unsupported holes. Flared eyelets or plated-through holes are conditionally permitted.
Type C—Standoff terminals

The printed wiring boards are to be fabricated from material conforming to Specification MIL-P-13949, "Plastic Sheet, Laminated, Copper Clad (For Printed Wiring)."

MIL-STD-429A

Printed-Circuit Terms and Definitions: A new revision

approved December 19, 1960 modifies many definitions to conform with current usage. Terms without special meaning when used in printed circuit literature have been deleted. The terms and definitions listed in the standard serve to emphasize the generic nature of the printed-circuit art. Components, circuits, and assemblies are intimately associated. Some aspects of this art are as follows:

(a) Printed circuits may result from entirely different processes, such as photoetching, silk screening, stamping, etc.

(b) Printed circuits involve printed patterns of dielectric, magnetic, or semiconductive materials as well as the more common conductive materials.

(c) Printed circuits may involve or consist of components both of a three-dimensional or essentially two-dimensional nature.

A printed circuit is defined as a pattern comprising printed wiring and printed component parts, all formed in a predetermined design in, or attached to the surface or surfaces of, a common base. A master drawing is defined as a drawing showing the dimensional limits or grid location applicable to any or all parts of a printed circuit, including the base. A master pattern is a 1-to-1 scale pattern which is used to produce the printed circuit within the accuracy in the master drawing.

MIL-P-55110

Printed Wiring Boards: A new coordinated specification (superseding BuAer Spec XAR-153 and MIL-P-21193 [NORD]) approved September 6, 1960 covers printed wiring boards consisting of a conductor pattern on a rigid insulating base. Printed wiring boards are intended primarily for use in electronic and electrical equipment used by the Armed Services to eliminate hand wiring. The design and construction of printed wiring boards is specified in accordance with MIL-STD-275. Master drawings are required showing the exact conductor pattern which will be formed on the printed wiring board.

Dial MIL-D 70327

Motion Picture for Loan

STANDARDS Engineering Documentation is the subject of a 25-minute motion picture available on loan from the Department of Defense. Titled "Dial MIL-D-70327," this film covers the military standardization program. Requests for the loan of this film should be addressed to the Commanding General of the appropriate Army Area. Attn: Signal Officer. Army Area Headquarters and the states they service are listed below:

FIRST ARMY
Governors Island
New York 4, N. Y.
Attn: Signal Officer

Maine	Rhode Island
New Hampshire	Connecticut
Vermont	New Jersey
Massachusetts	New York

SECOND ARMY
Ft. George G. Meade, Maryland
Attn: Signal Officer

Pennsylvania	West Virginia
Maryland	Kentucky
Virginia	Delaware
Ohio	

THIRD ARMY
Ft. McPherson, Georgia
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North Carolina	Alabama
South Carolina	Tennessee
Georgia	Mississippi
Florida	

FOURTH ARMY
Ft. Sam Houston, Texas
Attn: Signal Officer

Arkansas	New Mexico
Texas	Louisiana
Oklahoma	

FIFTH ARMY
1660 E. Hyde Park Blvd.
Chicago, Illinois
Attn: Signal Officer

Illinois	Nebraska
Michigan	Minnesota
Wisconsin	North Dakota
Missouri	South Dakota
Kansas	Wyoming
Indiana	Colorado
Iowa	

SIXTH ARMY
Presidio of San Francisco
San Francisco, California
Attn: Signal Officer

Washington	Utah
Oregon	Nevada
Idaho	Arizona
Montana	California

MILITARY DISTRICT OF WASHINGTON
Washington 25, D. C.
Attn: Signal Officer

District of Columbia and the Greater Washington Area
(All requests from Maryland and Virginia outside this area should be sent to Second Army as indicated above.)

Notes & Comment

Microfilm Convention

THE 1961 Meeting and Convention of the National Microfilm Association will be held April 4-6, at the Hotel Sherman, Chicago, Ill. Theme of this, the NMA's 10th Annual Program, is "Systems and Standards—A New Era in Microreproduction." Exhibits will contain cameras, processing machines, readers, enlargers, insert and aperture cards, mechanical handling equipment, continuous paper reproduction printers, and new processing solutions.

Vernon D. Tate, Executive Secretary of NMA, P.O. Box 386, Annapolis, Md., has information regarding registrations, exhibiting and the like.

New Precision Camera: The World's Largest

A NEW SERVICE is now being offered by the All-State Blue Print & Supply Co., of Columbus, Ohio. The company has recently installed a custom-built consolidated process camera with a reproduction capacity up to 60"x84" at 1/1000 of an inch accuracy without splicing. The camera is designed for reproducing planning maps, topographical surveys, engineering drawings, multiple patterns, aerial surveys, templates, photo enlargements, and printed circuit masters. This is a useful service for those companies which cannot or do not wish to make the considerable capital investment needed to install such a camera in their own plants. The service will be available after February 15. Complete information on this service can be obtained from the company on request.

Tech-Swap Plan

OPERATION Tech-Swap, a plan to collect and re-issue technical and trade papers received by industry to students in the Delaware Valley schools has been initiated by the Design and Drafting Council as part of its continuing objective of assisting technical school programs.

The Design and Drafting Council, P.O. Box 431, Philadelphia 5, Pa., will arrange for the collection and recirculation of the periodicals from companies in the Delaware Valley. The Council was organized over five years ago as an association of managerial level personnel representing industry, government and schools, and is dedicated to the advancement of the engineering drawing profession.

Corporate Name Change

IN VIEW of the diversified range of drafting products the company now manufactures, Koh-I-Noor Pencil Co., Inc., has changed its corporate name to Koh-I-Noor, Inc. Although the woodcased pencil is still the company's major line, new products such as technical fountain pens, drafting lead holders, drafting leads and other items, are becoming an increasingly important part of its business.

McCambridge Joins Pack

WEST COAST sales will be directed by Robert F. McCambridge, it was announced by Pack Mfg. Co., Logan, Utah. The company's basic product is the Interlock File which provides a complete filing system for engineering drawings, blueprints and tracings.

Peerless New President

RICHARD E. HANSON, former manager of the Special Products Division of Oxford Paper Co., and one-time marketing development engineer and regional sales manager with the Ozalid Division of General Analine & Film Corp., has just been elected president and chief executive officer of Peerless Photo Products Inc., of Shoreham, L. I., N. Y.

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In 7 "Color-Coded" precision line widths: 00, 0, 1, 2, 2½, 3, 4. Uses India (or regular) ink for ruling, lettering, tracing or writing, with equal facility.

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MODEL NO. 3060: The regular Koh-I-Noor Rapidograph Technical Fountain Pen with self-contained automatic filling system, and pocket clip, is a standard drafting room tool.

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Templates: Precision engineered for use with Rapidograph Fountain Pen, Koh-I-Noor Drawing Pencil, Leads and "Adapto-Clutch" Lead Holders.

KOH-I-NOOR Inc., Bloomsbury, N. J.

A study of microfilming in engineering drawing departments

THE ENGINEERS and draftsmen who read GRAPHIC SCIENCE indicate there is both an upsurge in microfilm interest and a difference between the engineering department with a microfilm system and the one without such an installation.

Some 328 readers—or more than 3% of the total circulation—tore out a postcard to answer some 18 questions about microfilm, engineering practices and military standards.

Almost half of the respondents—47% to be exact—say their company now has a microfilm installation. The postman rang while one respondent was setting up his installation. Three other respondents said they had only partial installations and four more used microfilm solely for security.

Of the 53% who don't use microfilm, some 80% are considering it, about 18% aren't looking at it, while the remainder aren't even talking about it.

On the other hand, the users have big plans. Some 77% of them say their microfilm program is going to get bigger, another 15% say the program is not going to increase, while the other 8% didn't answer the question.

The impact of military standards is readily evident from this survey. Some 52% of the respondents work to Mil Stds., another 44% don't, and the other 4% said nothing on this question.

The Mil Stds. for engineering drawing practices have carried over into the microfilm programs. Of the 47% with microfilm programs, 43.5% of this group use Mil Stds. in their microfilm operations. Another 41.3% say they are not using these standards and 15.2% didn't discuss it.

Almost half of the people with microfilm programs in the engineering department have aperture cards. The exact number is 47.3% out of the 47% of yes respondents. Another 51.2% don't have aperture cards and only 1.5% did not answer this question.

INTERESTINGLY enough, more than 80% of the engineering departments with or without microfilm use multiples of 8½ x 11″ as their drawing standards.

The microfilmers have 82.5% and the non-microfilmers have 83%. A higher proportion of microfilmers—16.8%—don't have 8½ x 11 multiples as contrasted with the non-microfilmers—12.2%. The difference in percentage in this area should indicate that filing problems may have been a factor in some decisions.

Again, there is a difference in reduced-size print usage. Of the microfilmers, 44.3% use reduced-size prints and 52.7% don't. The non-microfilmers have 38.1% in reduced-size prints and 54.4% who don't use smaller prints. Either way you look at it, miniaturization appears to be a factor in engineering procedures.

On maintaining line balance and density on tracings and revisions, there is a definite difference between the microfilmers and the non-microfilmers. Of the microfilmers, 67.2% maintain such line balance and density. Among the non-microfilmers, 59.1% said they did.

WHAT'S HAPPENING to the roll-size drawing? The microfilmers—some 52.6% of them—say multiple sheets are replacing rolls. The non-microfilmers have 47% substituting multiple sheets for roll drawings.

Interestingly enough, more microfilmers have roll-size drawings larger than 36″. In the microfilmers, it was 20.4% with the larger sizes versus but 9.5% among the non-microfilmers.

The questions most unanswered concerned deviations from military standards. Among the microfilmers, 18.3% allow one person to decide on deviations from military standards. Another 48.7% said no and 33% didn't answer this question. For the non-microfilmers, 22.4% allow one person to decide on deviations, 38.8% said no, while 38.8% had no answer.

An awareness of drafting departments to records handling costs appears evident. Among the microfilmers 51% question the use of E-size tracings, 33% don't. For the non-microfilmers, it's 42% who question and 39.4% who don't.

Is the engineering department with a considerable quantity of large-size tracings more likely to use microfilm than the one with a lesser quantity? Every reader of GRAPHIC SCIENCE should make his own interpretation. The results show strength for both sides.

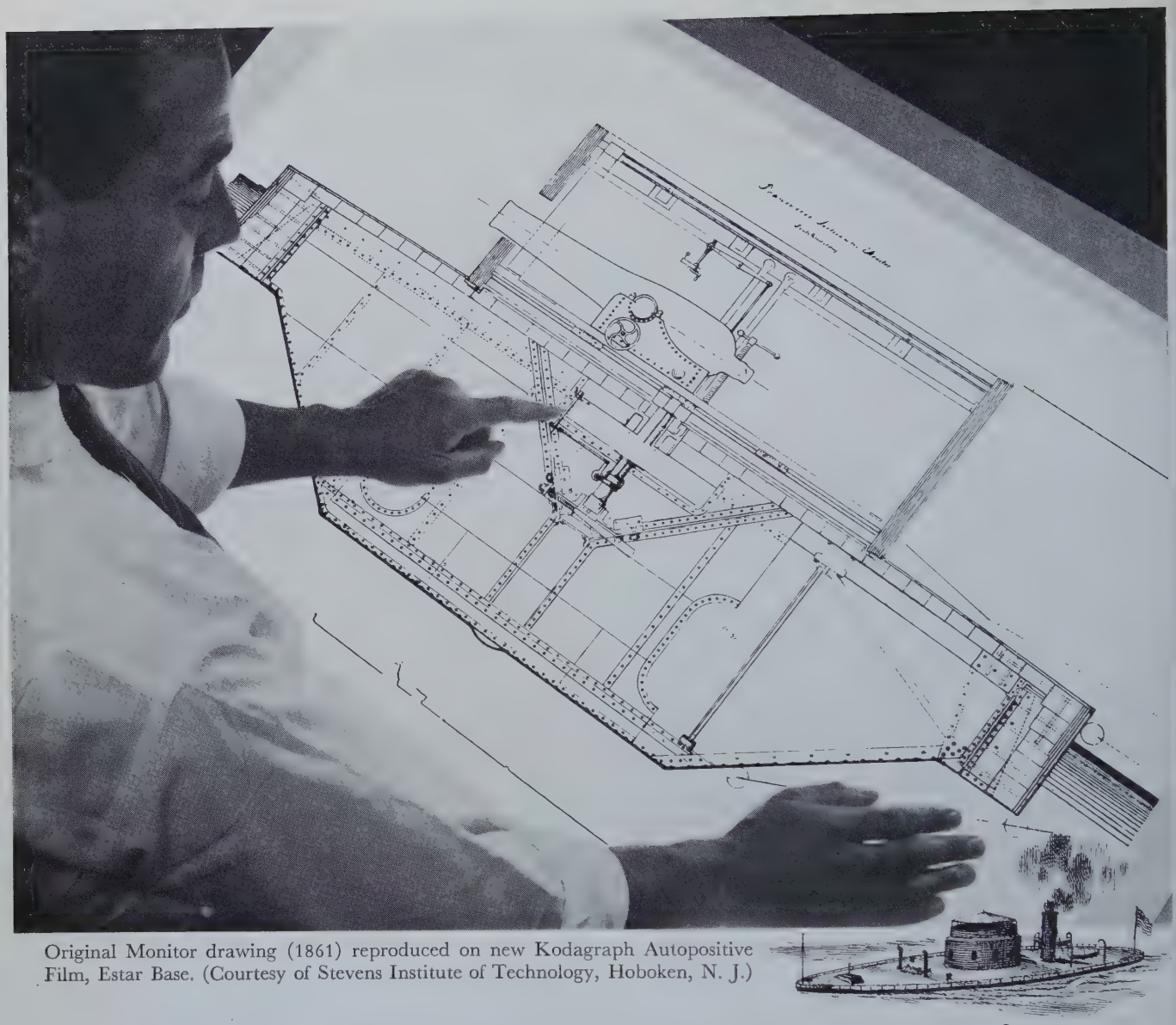
The question asked in the survey was: "What percentage of your tracings are larger than 22 x 34 inches? Here are the answers:

	Microfilmers %	Non-Microfilmers %
None	5.3	4.7
Less than 5%	32.7	36.7
6-10%	16	14.2
11-20%	12.3	15
21-30%	9.8	10.7
31-50%	9.2	7.4
More than 50%	11.3	6
Unanswered	3.4	5.3

INTERMEDIATES, the survey showed, have an important place in the engineering department. Among the microfilmers, 56.5% made prints from intermediates, but 43.5% don't. For the non-microfilmers, the score was 45.6% making prints from intermediates and 51% not making them.

Considering intermediates, are 22.8% of the microfilmers, but 68.5% say they are not. On the other hand, more non-microfilmers are considering intermediates. Some 32% of them say yes, while 61.3% say no.

More microfilmers make the majority of their prints from intermediates as contrasted with non-microfilmers. Some 39.2% of the microfilmers use an intermediate for prints, 52.6% don't. On the other hand, 28.3% of the non-microfilmers use intermediates while 61.3% don't.



Original Monitor drawing (1861) reproduced on new Kodagraph Autopositive Film, Estar Base. (Courtesy of Stevens Institute of Technology, Hoboken, N. J.)

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GRAPHIC SCIENCE

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POLYESTER FILMS FOR DRAFTING AND REPRODUCTION

An independent investigation reveals how to get the best results with polyester films and related materials

by Ernest D. Acevedo

In recent years the draftsman and reproductionist have been introduced to polyester films for use as drafting and reproduction media. The average draftsman's unfamiliarity with this medium, combined with the vague and conflicting claims of the manufacturers and distributors, has often led to poor results with this new family of products. These same conditions have also led to the rejection of these products that might otherwise have been of benefit to a drafting room. Because of this inadequacy of information, the chief draftsmen of the Department of Water and Power deemed it advisable to investigate the proper usage of those films and related materials. Many manufacturers' and distributors' representatives were of inestimable help in contributing toward this report.

Base Materials

These films are made from polyethylene terephthalate, the polymer formed by the condensation reaction between ethylene glycol and terephthalic acid. This film is tough and durable and remains flexible and stable over a range of temperatures from -60° to 150° C.

"Cronar," "Mylar," and "Estar"—copyrighted trade-marks—are practically the same chemically. These names should not be used to describe the whole class or a finished product.

Cronar is manufactured by DuPont's Photo Products Department for use as a photographic base material and related applications. Cronar is used as the base material for all Cronaflex products, which are also coated by DuPont's Photo Products Department. Dealers of Cronaflex products have their own name or catalog numbers for these products; consequently, the same basic product may be known by many different trade names.

Mylar is made by DuPont's Film Products Department for industrial use and is adaptable as a base for drafting films. This base material is sold to manufacturing distributors who apply a coating which becomes a working surface for drafting. Some also sensitize either the original glossy surface or the surfaces they have made "matte." These sensitized products are, of course, used by the reproduction man.

Estar is manufactured by Eastman Kodak's Graphic Reproduction Division for use as a photographic base material. This base material and its finished products are the most recent ones on the market, and have not yet been tested by us.

Physical Properties

Some of the notable characteristics of polyester films as applied to our industry are the following: outstanding dimensional stability, resistance to warping or buckling, imperviousness to humidity and varying thermal conditions. Also these films provide great transluscency, high tensile strength, resistance to fraying of edges, and non-absorption of liquids and gases.

To expand on some of the characteristics let us first consider dimensional stability. For general drafting and reproduction work, polyester films possess a greater stability property than do tracing cloths or papers. Changes in the dimensional stability of a drawing can be calculated where stability is a critical factor, such as in scribing, lofting or printed circuits. Coefficients for thermal and humidity changes are available from most distributors for use with their respective films.

Possessing high tensile strength, these films cannot be torn by hand; however, once a tear has started, they will tear almost the same as tracing cloth. But, because of resistance to warping or buckling, a tear will not progress as fast on these films as on tracing cloth or paper until it can be mended.

Common problems of drawing edges on old and worn drawings—edges that become frayed or shred, dog-eared at the corners, and split or cracked—will be eliminated by the durability of these films.

Accidental solution spills or sweating hands will not stain, wrinkle, or pucker the film. It should be noted that while some liquids such as benzene, alcohol, or water will not damage the films, they will destroy or damage the line work.

The films have excellent light transmitting properties making them ideal for overlays, tracings, or reproduction work. Some of the films will not discolor or form a yellowish tint with age. Films that will discolor are primarily those that have been sensitized with photographic or diazo emulsions. Only the surface layer will discolor and not the base material.

The above-mentioned properties apply to all polyester films since these are characteristics of the base material. Quite naturally, the products, as they are modified by the drafting materials or reproduction products coater, will vary in quality and in the nature of the surface applied for drafting and/or the sensitizing for reproduction purposes.

Matte Surface

The matte surfaces generally will accept both drawing pencil and ink, but some are tailored for ink use. In any event, the pencil and ink used, along with the erasers and eradicators are of a new special character, specifically manufactured and engineered for use with these new films. The technique in their use is not simple, and one should not give up too easily in its mastery.

The matte surface is in most cases included in the advertised film thickness. This surface layer may be as thick as .0005″. Polyester films are available in a great number of gauges. For drafting and reproduction purposes the gauges between .003″ and .005″ are the most popular. The former corresponds roughly with the thickness of tracing cloths.

Testing

The wide variety of grades and brands of materials available on the market compelled us to restrict our testing to the most popular items. The possible combinations of inks, films, leads, and erasers are innumerable.

Tests were conducted to determine which products are best suited for the various types of drafting employed by the Department and to develop correct techniques to achieve the maximum advantage from their use.

To be effective for Departmental use, drafting materials must meet certain requirements such as, numerous revisions, erasures, reproductions, frequent handling and a life span of over thirty years.

Other factors taken into consideration were of equal importance. These factors were applied to the related materials as well as to the various films.

1. The quality and texture of the materials must at all times be uniform to insure uniformity of line work and reproductions.
2. The type of work being done, whether it may be the fine ink lines of our pipe location maps or an architectural rendering, will certainly govern the selection of the materials used.
3. The method of reproduction to be used will in most cases be governed by the density of the line work and the translucency of the drawing material.
4. The availability of stock, quantities used and storage requirements affect time, money and the uniformity of supplies.
5. Finally, the draftsman's personal preference may be one of the most important factors to be considered. A new product may meet all of the requirements mentioned, but the familiar and habitual usage of common drafting materials may work against its adoption.

Preliminary Tests

Preliminary testing of polyester films and the related products by application of the previously mentioned conditions reduced the number of products to be subjected for further testing. The final number of products tested was six brands of polyester films, five brands of leads, five brands of erasers, four brands of inks, and miscellaneous surface cleaners and eradicators. The objectives of the final test were as follows:

1. Leads were tested for erasability, smudging, point strength, wear, uniformity of grading and lead centering.
2. Inks were tested for their ability to bond with the film's surface.
3. Erasers and eradicators were tested for their ability to remove a line thoroughly, with ease and without damage to the film's surface.
4. Reproductions of and from polyester films were tested for sharpness and clarity of detail.

The testing was conducted in the drafting room and in the Department's testing laboratories. All advertised claims by the manufacturer or distributor were tested to the best of our abilities. Only in the case of dimensional stability did we accept the manufacturer's claims since our work will not justify the need nor the higher premiums for the thicker films which are more stable than the thinner films.

For testing purposes and classification the films were divided into three major types, drafting, photographic and Diazo.

Drafting Films

The drafting films, as previously stated, are matted to accept both drawing pencil and ink; and some are made more specifically for ink work. The tough surface of the drafting film will accept lead grades of 4H in graphite, #5 in plastic, and #44 in the F.T.R. lead. Repeated erasures will not harm the surface if a soft rubber eraser is used. The ink film has a softer matte than the general drafting film and is restricted to softer lead grades of 2H in graphite, #3 in plastic and #22 in the F.T.R. lead. Erasing on ink film should be done with the soft vinyl erasers.

The lead grades recommended are for general usage on all polyester films. It should be noted that the draftsman's personal preference, technique and brand of film used will determine the final selection of the lead grade to be used.

Photographic Films

The photographically sensitized films are of three kinds: contact film which is used for making same-size reproductions from new

or old and worn drawings via a film or paper negative; positive-type film which is used in making same-size intermediates directly without the need for a negative; projection film which is used in making blow-backs from microfilm negatives or reductions or enlargements of standard drawings.

One should note that if the photographic film is matted on both sides, each will be different. The side on which the image is placed is gelatin coated to accept the photographic emulsions. Consequently this surface will have the same restrictions as those of the ink film. The other surface will be the same as the general drafting film.

Diazo-type sensitizing has been improved a great deal in the field of polyester intermediates. This medium is manufactured in sepia line and black line. The coated side is usually the glossy back side, leaving the up surface adaptable for drawing. Both diazo and photographic polyester reproduction films can be made either reverse or right reading.

POLYESTER FILMS

Films	Distributor	Base	Film Type	Repro Type
Polytrace 392	Bruning	Mylar	Drafting	None
Surescale C 396	Bruning	Cronar	Drafting	None
Ageproof	Dietzgen	Mylar	Drafting	None
Driprint	Dietzgen	Mylar	Black Line	Diazo
Driprint	Dietzgen	Mylar	Sepia	Diazo
Herculene 163	K & E	Mylar	Drafting	None
Herculene 411	K & E	Mylar	Direct Positive	Photo
Herculene 419	K & E	Mylar	Projection	Photo
Helios 517K	K & E	Mylar	Black Line	Diazo
Helios 517	K & E	Mylar	Sepia	Diazo
Stabilene 130	K & E	Mylar	Drafting	None
Stabilene 571	K & E	Mylar	Contact	Photo
Stabilene 591	K & E	Mylar	Projection	Photo
P.T.F. 126	F. Post	Mylar	Drafting	None
VapoTuf-Tex 208PE	F. Post	Mylar	Black Line	Diazo
Cronaflex D.F.	Various—	Cronar	Drafting	None
Cronaflex U.C.	DuPont Photo	Cronar	Drafting (Ink)	None
Cronaflex DPM	Products Div.	Cronar	Direct Positive	Photo
Cronaflex CFM		Cronar	Contact	Photo
Cronaflex PFM		Cronar	Projection	Photo
Pencron	L. L. Ridgway	Cronar	Drafting	None
ZFWL-Mylar	Technifax	Mylar	Drafting	None
MYBKLM-Mylar	Technifax	Mylar	Black Line	Diazo
Kodagraph A.F.	Various-Eastman	Estar	Direct Positive	Photo
Kodagraph C.F.	Kodak Graphic	Estar	Contact	Photo
Kodagraph P.F.	Repro. Div.	Estar	Projection	Photo

Film Type	Used for
Diazo	Positive intermediates made in office
Direct Positive	Positive intermediates—same size
Contact	Restoring and copying—same size
Projection	Reductions and enlargements

Diazo-Type Films

Diazo-type film has the same surface as the general drafting film. A few producers make a double matte diazo film; however, the image side will be almost the same as the drawing surface.

Polyester films are also available imprinted with non-reproducing grid lines, plan and profile lines, adhesive-backed for use as decals, coated with scribing surfaces, as well as clear as it comes from the original manufacturer.

Eradication of the photographic image is done with silver-dissolving erasing fluids. These fluids should be applied with cotton swabs or Q-tips, following instructions carefully in their use. Eye droppers furnished with these erasing kits should never be used as scrapers in removing the image because the fluids tend to soften the gelatin coating, and a scraping action can permanently damage the matte. Films should be completely dry before attempts are made to redraw on them.

The diazo-type image must be rubbed off, scraped off, or chemically softened and wiped off. This is the only time an erasing machine can be safely used since the image side is generally not used for drawing. Another problem of diazo is that the eradicated area will reproduce much lighter in contrast than the un-marred areas.

Diazo and photographic processes may fulfill any reproduction requirement that may arise. Each has advantages over the other.

Advantages of photographic film over diazo are:

1. Sharper detail.
2. Higher contrast between line and background.
3. Enlargements and reductions of drawings.
4. Microfilm reproduction.
5. Excellent scale retention.

Advantages of diazo film over photographic are:

1. More economical.
2. Faster (can be made on a whiteprint machine).
3. No special training required for development.
4. Decals can be made on a whiteprint machine.

Recommendations

The following recommendations can be applied to all films in general along with the previously recommended lead grades:

1. Avoid the use of a back-up sheet for contrast while drawing; this tends to engrave or emboss the surface of the film. If tracing or overlay work is to be done, use leads which are softer than those recommended, and ease up on the pencil pressure.
2. Avoid the use of chisel and sharp needle points, as they tend to cut through the surface layer.
3. Avoid the use of hard leads, because they produce light, weak lines and engrave the surface, making erasures difficult.
4. Label each drawing on one of the corners with the brand name, thickness and type of lead or ink used. This will insure uniform work for future

Crease Marks

Returning to the matte surface, most producers will claim that crease marks will not print. This statement is not entirely true. Crease marks will print darker on a single matte than on a double matte. This is due mainly to the diffusion of light which is greater on the double matte. Also, crease marks which are concaved against the sensitized print will reproduce more than those which are convexed. Lines drawn over a crease mark will tend to skip. This will also show up on reproductions.

If a drawing gets badly wrinkled or creased and will not lie flat, pass it through a diazo machine at a slow speed a few times, making sure that it does not pass through the ammonia developer. This will help, but it will not completely eliminate the damage.

Double Matte

The double matte surface may have the advantage of two working surfaces, but when filed together these surfaces tend to cause an abrasive action against each other. This abrasive action may increase the smearing of graphite and it will produce static electricity.

The use of horizontal or vertical filing methods should not be contributing factors to smearing, crease marks, or static electricity. The proper handling of the drawings and enforced, correct filing procedures will eliminate these problems at the file cabinets. Careless handling, by anyone, from the draftsman up to the engineer who approves a drawing, is the only cause of dirty and creased drawings.

Mending Drawings

Drawings that become torn can be mended with 3M #810 tape or Mylar mending tape. These tapes will accept lead or ink, making it possible to place them on the working surface if desired.

Pencils and Leads

Among the new materials that have been developed along with polyester films are two new types of leads. These leads were made primarily for use with the polyester films.

The first lead type to be developed is made of a plastic base. Plastic leads will not smear readily and produce ink-like drawings. These leads cannot be used in the same manner as graphite leads. Since they are made of a plastic material, they tend to be more flexible and will chip under less pressure than graphite leads.

The best way to use these leads is with a short rounded point, and it may be necessary to go over a line a second time to insure a good bond between the lead and the film's surface. Practice will develop skill, so do not be discouraged or reject these leads until you have completed a few drawings.

Only one of the three plastic leads tested will form a waterproof bond. This waterproof bond will be formed on three major brands of polyester films. Representatives of the pencil or film companies can recommend lead and film combinations that form a waterproof bond.

After the drafting films had been tested and found to form a waterproof bond, it was noted that the lead would wash off when used on the emulsion side of a photographic film of the same brand. The gelatin coating on photographic films reduces or eliminates the ability of these leads to form a waterproof bond.

The practice of washing drawings that are made with plastic leads as advertised, should be done with great care. As stated, these leads will not be waterproof on all films, so test a small area before attempting to wash a complete drawing. A mild soap, luke-warm water and a soft sponge should be used to wash drawings. A drawing should be washed as infrequently as possible, since each washing will remove some of the plastic lead.

Plastic leads are graded from K or M, 1 to 5, soft to hard, when the regular grading system is not used. These leads are limited to films and cannot be used satisfactorily on cloth or vellum.

Graphite Base Pencils

The second type of lead that has been developed is a graphite lead made with a special resin to produce a very hard lead. These leads have a superior point of strength and will wear longer than regular graphite leads. The leads are graded F.T.R. 11, 22, 33, 44, 55, and 66, soft to hard. These leads are not restricted to films; they can be used on cloth or vellum.

Regular graphite leads can be used satisfactorily, although graphite tends to smear more readily on films than on cloth.

Erasers

Vinyl-type erasers are best used for erasing the plastic leads. Some brands are also excellent for removing graphite leads. Graphite and smudges can also be removed with a standard non-abrasive eraser. Erasers containing gum or oils are not recommended for use on polyester films. Erasers of this type tend to deposit a residue on the film, which makes redrawing difficult.

Slitting an eraser along the rubbing edge with razor cuts ⅛″ deep and ⅛″ apart, will increase its efficiency, reduce smearing and minimize the heat generated by friction.

The use of erasing machines has become a controversial point among users and producers of film. Some draftsmen can make repeated erasures on the same area without damage to the film's surface, yet the hazard of an inexperienced individual ruining the surface can exist if machines are used. If vinyl erasers can be made for use with erasing machines, then the machines may be satisfactorily used.

Redrawing over erased areas will vary a great deal and will depend on the film, eraser, and type of lead used. One combination of eraser and lead may produce excellent results on one film and be completely unsatisfactory on another film. Only trial and error can produce the proper combination, once the film brand has been selected.

Inks

Waterproof inks commonly used on cloth will not bond with polyester films, unless a chemical adhesive is added to the ink. In a short time these inks will peel or flake off.

Etching inks should not be used since they tend to eat into the surface, making erasures difficult.

Acetate inks have produced the best results when used with a sharp, narrow-point ruling pen. Fill the reservoir with only a small amount of ink at a time, using fresh ink and a gentle "floating" action, to produce good line

work.

Dirt and grime will lay on the surface of the film since they cannot penetrate into the film and may obstruct the line work. A surface cleaner, preferably the dry type should be used to prepare the surface for drawing and to restore the matte after erasures have been made.

Pencil layouts made prior to inking should be as light as possible. Graphite and especially plastic leads form a barrier, which may reduce the bond betwen the film and ink. A solution to this problem may be in using the film as an overlay. Since it is highly translucent, the layout work can be drawn on a separate sheet and the ink work can then be traced.

Eradication of large areas of ink can be easily done with a clean moist cloth. To remove small areas use moist cotton swabs or Q-tips. A moist semi-abrasive eraser can be used on small areas or stubborn spots.

Another method used in removing large areas on a drawing is to make an intermediate as a new master. During the process of making the intermediate, a mask of the drawing is made so as to burn out the unwanted areas. This process may be more effective and economical in the long run, since the drafting surface will not be ruined or become inferior to the original surface after a time-consuming eradication method is used.

Chemical pencil-line removers and ink removers were usually limited to the manufacturer that produced the film. If chemical eradicators or water is used, make sure that the surface is well blotted and dry before attempting to redraw.

General

Producers of polyester films and related products are continually improving their products, and as they do so they should provide their users with more specific information. Testing programs can be expensive for a small drafting organization.

The cost of polyester films has continued to decline since they were first introduced. Prices will also fluctuate under the competitive bidding system and regional demands. Therefore we make no attempt to show comparative costs of these films.

The increasing number of brands of polyester film and the increasing amount of sales clearly indicate the acceptance by many drafting rooms of the use of polyester films as drafting and reproduction media.

Although advantages of this film product are gratifying and numerous, there still remains a problem in getting the individual draftsman to learn its specialized uses. The use of polyester drafting and reproduction films can free the draftsman from routine and tedious copying so that he may be used for constructive and original work.

This article and the attached chart are for informative purposes only. They in no way signify a product preference by the Department of Water and Power or the author of the article. Products not mentioned here were not available or known to the author.

The Author

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PREFOLDED DIAZO PAPER

If you make a substantial quantity of diazo prints from roll-size drawings, it will pay you to use prefolded, rerolled paper

by Ralph A. Krauss

Significant labor saving in the reproduction room has been achieved by the introduction of prefolded blueline (diazo) paper in 36″ rolls. To realize this advantage, it is obviously necessary that roll-size prints be a significant fraction of the average daily footage.

Blueprint paper, by way of contrast, fails to exploit the advantages of prefolding, since the wetting and heat-drying in the continuous printing machine completely flatten out the creases.

Prefolded paper is reported to have been first used in 14″ widths for oscillograph records obtained in seismic exploration, and its use had been confined largely to Texas. Late in 1958 John Carpenter, of the Burroughs Research Center in Paoli, Pennsylvania, recognized the potential advantages of prefolded paper for prints of "roll-size" engineering drawings, and persuaded one of the manufacturers to supply a few hundred yards of 36″ blueline paper in loose 11″ wide accordion folds. It was tested extensively in normal daily use on Revolute Star whiteprinters.

Labor Savings

Obvious at once was the reduction in labor. Previous to the use of prefolded paper, the 36-inch strip issuing from the delivery end of the machine onto the runout table at 20 to 30 feet per minute was handled about like this: the leading edge (title block end) and trailing edge were trimmed with shears. The length of the print was then reduced to 11 inches by accordion folding, with the title block facing out. The 36″ width was then reduced to 9 inches by two ordinary folds, again with the title block facing out. This method of folding is commonly used, and conforms to Military Specification MIL-D-5480d. The 11″ accordion folding is quite laborious, and three men are required to operate the machine, since two men at the delivery end, trimming and folding, can just about keep up with one man feeding.

With the prefolded paper, only one man is needed at the delivery end. He grasps the two ends of the long sheet and pushes them together along the 8′ runout table. The accordion folds drop into place, and the laborious operation has disappeared together with one third of the labor cost.

Prefolding Methods

It also became evident that loose accordion folded paper brought problems of its own, all stemming from the fact that it is difficult or impossible to maintain tension in the paper as it feeds from the supply box. The tearing wire will not function, and the paper will not track straight. Several contraptions were designed and built in an effort to create tension in the paper. They were all unsuccessful.

The practical solution was found in rerolling after prefolding and another manufacturer supplied samples. It appears that the folding machine creases sharply enough to create a permanent set, possibly by breaking some of the fibers. Be that as it may, when the paper is unrolled, and even after it is ironed out in the machine, the folds restore themselves with very little manual assistance.

The value of prefolded paper having been proven in actual practice, the next problem was to obtain a source of supply. In the absence of fairly substantial demand, most manufacturers were understandably reluctant to invest in the needed expensive equipment. But, just as plans were being completed for a demonstration to inspire such a demand, one of the manufacturers offered to supply the product in quantities sufficient for our needs, and we were in business.

The prefolded, rerolled paper is obviously more costly, the difference being about 35% or $.0025 per square foot more than the non-prefolded paper.

Waste Control

To be perfectly fair, however, we must consider some additional wastage as a consequence of the prefolding. If we are to wind up with the title block facing out, that end of the tracing must be—as it usually is—fed in first, and the trim line registered with a "valley" fold of the paper. Whether the lengths of drawings are perfectly random or in 11-inch increments, the average unavoidable waste between prints will not exceed 11

inches. By contrast, with non-prefolded paper the leading edge of a tracing can be "tailed" behind the preceding one without any wasteful gap, provided the operator's skill is equal to the machine speed.

The percentage of this unavoidable waste due to prefolded paper depends upon the average length of the prints being made, but it can hardly exceed 20% under the worst conditions. Thus, the total cost of paper is increased by something less than 60%, but the cost of labor is reduced by more than 33%. This may not sound impressive, but in the usual case, the labor cost greatly exceeds the material cost. The computation of real savings involves several controversial questions such as how much burden should be applied to the basic labor rate and how effectively the released labor can be assigned to other productive or necessary work. But perhaps the most important advantage is that the increase in manpower efficiency increases the ability of the reproduction room to cope with sudden and unexpected peak loads, rendering faster service, and increasing the effectiveness of highly paid engineers thereby.

The Great Valley Laboratory of Burroughs Research Center has been using prefolded paper in rolls since May 1959 and it has proven satisfactory in every way. Very recently, another manufacturer has made this paper available. We have tested several rolls and found it entirely acceptable.

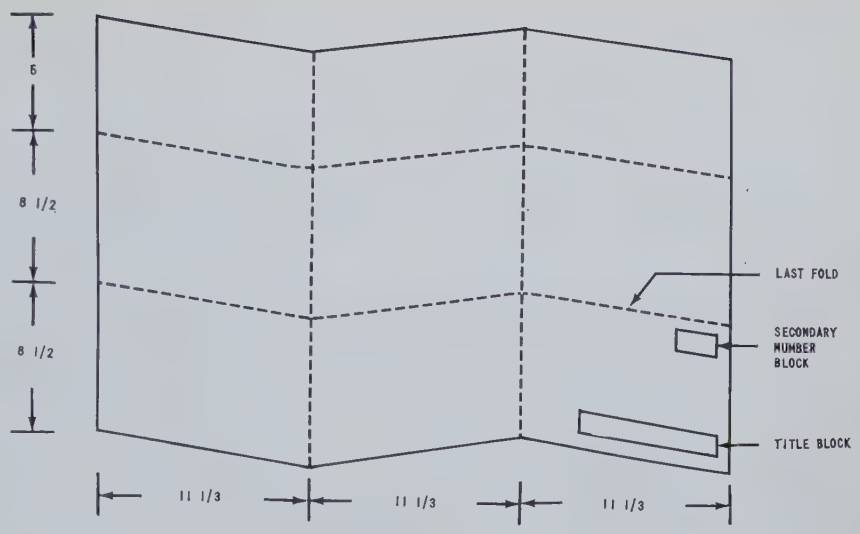
Prefolding Cut Sizes

The success of prefolded roll stock automatically leads to the desire to expand the advantages into the cut sizes. The standard drawing sizes at Burroughs Corporation are:

A — 8½ × 11
B — 11 × 17
C — 17 × 22
D — 22 × 34
J — 34 × 50 min.

All but the J size drawings are printed on cut sheets. If prefolding of cut sheets presents any advantage it would be most conspicuous on the D size. Standard practice at Burroughs Great Valley Laboratory is to fold the D size print as shown in accompanying illustration.

The vertical folds are accordion-fashion, and the lower right corner panel is on the outside of the folded



Standard practice for folding D-size prints at Burroughs.

print. This arrangement files conveniently and is also in accordance with MIL-D-5840d, except possibly for the 11⅓″ spacing (instead of 11″) which avoids the awkward 1″ excess. An official ruling on this point has yet to be obtained.

Feeding the paper into the machine, the creases must transverse; if longitudinal they are not flattened completely by the belts and cylinder and a shadow is prone to develop, particularly at the left-hand or "valley" fold. A print thus occupies a 34″ length of the machine rather than 22″, reducing the production efficiency of the machine—and the whole crew—by 35%. This is important if a slow printing speed is used, but with the powerful lamps and fast papers available today, the prints will go through as fast as the operator can start them in, retrieve the tracing, and assemble the next set.

The fact that creases parallel with the belts will generate shadows is sufficient reason not to prefold in both directions. Whatever is to be gained in manpower efficiency must not be at the expense of quality.

A few hundred D-size sheets were prefolded by hand and tested in normal use. The results were not encouraging. A 22 x 34 sheet is large enough to be awkward to manage, and the necessity for placing the 34-inch dimension parallel with the movement further complicated the situation. An extension to the feed table might overcome this handicap, but space does not permit this.

Under favorable local conditions and by the exercise of some ingenuity, the problems might be overcome to the extent that prefolded cut sizes—D, and smaller sizes as well—would achieve some worthwhile economies. At least one of the major suppliers is thinking about marketing prefolded cut sheets, but none are commercially available at this writing.

Should anyone wonder why D size prints cannot be run on roll stock, the answer is that they can, but the extra labor in cutting apart (even if no trimming is required) is far more costly than the very small added cost of cut sheets. And as for printing D sizes on prefolded roll paper, the same drawback exists, plus the fact that the 11-inch folds run the wrong way and the print must be turned at right angles to its proper file position, and this does not conform to MIL-D-5480d. Alternatively, the tracings may be turned 90° so that only 22 inches of the 36-inch width are utilized. At the same time only 34 inches of every 44-inch length increment can be used. The waste of paper is excessive (over 50%), and the extra labor of trimming more than nullifies any saving in folding.

To summarize: if you are making any substantial quantity of diazo prints from roll-size drawings, it will pay you to buy prefolded, rerolled paper.

The Author

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A BLUE PRINTER LOOKS AT MIL-D-70327

How the commercial blue printer can help assure the success of the new standardization program

by William F. Blocher

THE NEW MILITARY specification, MIL-D-70327, covering "drawings, engineering and associated lists," is going to be of interest to commercial blue printers whether or not they are directly concerned with government contracts.

This is true because it is going to have far-reaching effects on the type and quality of original drawings to be prepared by prime contractors and subcontractors for all military departments. From the first sketches through to the approved pilot model, to the final finished production drawings, the skills of the blue printer are utilized to separate, assemble, reverse, enlarge, reduce, and strengthen these drawings. The reproduction of prints and data lists for release is only a part of our function.

We also enter the business area as purveyors of, and advisors on, all types of reproduction machinery and drafting materials and equipment. This places us in the position to be of material assistance to our customers and the military in compliance with the provisions of the new military specifications.

One of the announced objectives of the whole military program in this area is to improve the quality, and thus the reproducibility, of original drawings and engineering data lists. As commercial reproductionists, we can certainly subscribe to this objective.

Another laudable objective of the program is to facilitate distribution through various miniaturization processes and their related print-back methods. These miniaturization programs were developed through many meetings between industry and military personnel, and have resulted in harmonious, general agreement on accepted engineering reproduction methods systems.

The 35mm. miniaturization system is spelled out in MIL-M-9868, which refers to MIL-D-70327. The 105mm. miniaturization system for construction, architectural drawings, maps and related documents, is spelled out in MIL-P-9879, which refers to MIL-D-70327. The aperture card filing, sorting and data processing systems, are spelled out in MIL-C-9877 and MIL-C-9878, both of which refer to MIL-D-70327. In all, some 20 military standards are either called out in MIL-D-70327 or refer to it as setting the basic quality standards for drawings and data lists.

The goal of the military in this program is commendable. As commercial blue printers, we cannot but praise the objectives of this new program. We may question some of the methods, some of the areas in which they have attempted to hurdle conversion obstacles when there might better have been an orderly transition, but we approve their objectives.

WHEN THIS whole government project started, several years ago, IABPAI set up a special committee to work with the industry *ad hoc* group and the military on its planning and drafting. Our committee was able to suggest many changes in the original draft of MIL-D-5480, for example, adding new processes and revising descriptions of older processes to make them more meaningful.

When the military decided to standardize its whole system of filing and reproduction of drawings and data lists on 35mm. aperture cards, our committee pointed out the needs of the military for larger sizes of miniaturizations. As a result, authorization was spelled out in separate specifications for both 35mm. and 105mm. reproductions.

Private industry, it should be remembered, has done the basic research and spent the millions of dollars that have been necessary to develop miniaturization to the point where the military can attempt to standardize and, we hope, save millions of dollars in storage and reproduction time and effort. At the same time, as an industry, we commercial reproduction specialists would be derelict in our duty to ourselves and our government if we did not point out to the military, at this time, that we have the know-how and trained personnel to make this system work.

The military will do well to utilize our industry as a means of disseminating information and interpreting MIL-D-70327, as we have the knowledge and can analyze its potential. Our commercial plants are ready to go with any and all processes of repro-

duction of drawings and data lists. Economy of operation with us, as with any "captive plant" or government installation, depends upon utilization of facilities to the fullest extent possible.

FROM THE work-horse type of reproduction necessary to prompt distribution of engineering information—through the development of the product, to data submittal—we commercial blue printers keep up to date in our plants.

This means considerable investment today, when you consider:

1. Recent developments in diazo with new products as base materials,
2. The quality and build-up of drawings by contact frames and 105mm. projection systems,
3. The improved camera techniques for enlargements and reductions, to say nothing of the value of screen process phototracings,
4. The cost savings of flow-type reduction cameras for final masters which can be produced economically during product development, and
5. The flexibility of final reproduction on 35mm. in aperture cards with attendant sorting and filing economies.

All these systems, in one way or another, are necessary to the full utilization of the new MIL-D-70327 concept.

Cooperation between the government, its prime contractors and subcontractors and the commercial blue print industry, can assure success of this new standardization program. Selfish lack of cooperation, by any of the three partners, or over-selling of any single technique, product or process, can put the whole program on its back before those who are supposed to use it begin to understand what it is all about.

Government procurement officers and project supervisors should start now encouraging prime contractors to utilize as much available commercial blue printers' machine-time as possible. Cost savings will inevitably result, and, militarily speaking, dispersal, a security necessity, will automatically occur.

A national "alert" study, only a few years ago, disclosed that this reproduction industry is one of the most essential. Its dispersal is absolutely essential to the survival plans of any post-attack period.

The commercial reproduction industry developed the newly adopted system specified in MIL - D - 70327. The military has adopted it, and is spelling out perfections that are "consummations, devoutly to be wished." They will take place only if the military provides sufficient volume for independent contractors to justify the purchase of equipment, research and training of personnel necessary to implement the system and develop it further.

Hundreds of millions of dollars are going to be required in the purchase of new equipment, research, and training of personnel to operate the equipment, and it is going to take lots of military work in commercial shops to help foot the bill. If the military undertakes to do the whole job itself, in its government shops or through encouragement of captive plant growth, it is going to have to foot the bill—*in toto*. In the end, it will have an uneconomic, concentrated, attack-exposed, expensive, competitive operation that will stifle commercial industry participation.

The commercial reproduction industry stands ready to make the necessary new capital outlays. It has the know-how. It has the trained personnel and will train the necessary new recruits. It is "tooling up" the same as the military and its prime and subcontractors. Private industry needs only the go-ahead from the military and its prime and subcontractors to become partners in the tremendous task ahead of removing some real roadblocks in the path of MIL-D-70327.

Engineering and drafting department heads of prime and subcontractors are already decrying the added costs of compliance with MIL-D-70327. To them we say, "Consult your local commercial blue printer. He will help you cut your costs and comply." To military procurement officers, we say, "Don't get caught with antiquated equipment. This is a fast-moving industry that develops new and better processes before the ink is dry on the drawings of the old. Consult your local commercial reproduction specialist. He is tooled up or will tool up with the latest equipment to meet your needs and his business is keeping up to date, the better to serve you."

The commercial blue printer's ability to serve the military and military contractors is subject only to the limitations of the equipment available. We have had years of practical experience with the myriad kinds of equipment in production and experiment. We can divide capital, research, and training costs between military and commercial users. As an industry we must and will help the military and military contractors hold these costs to a minimum. Commercial blue printers, if given the opportunity, will help make MIL-D-70327 work.

The Author

WILLIAM F. BLOCHER, Blocher Blue Print & Supply Co., 1021 20th, N.W., Washington, D. C. Mr. Blocher is a Past President of the International Association of Blue Print and Allied Industries (IABPAI) and a member of the Association's Military Specifications Committee.

Pencil Techniques Can Improve Microfilm Clarity

Nine ways to improve legibility

by Ernest M. Raasch

HAVE MICROFILMS of your drawings been rejected? They probably have, if your experience is similar to that of most drafting rooms. Our investigation shows that nearly 15% of all microfilm must be rejected on the basis of illegibility. This varies by drafting room from a low of less than 1% of frames, to a high of 20%. Ordinarily, when the rate of rejection of frames within a roll is 20%, the entire roll is rejected. Hence the actual average rate of rejection may well be above 15%.

This expensive loss of draftsmen's time, reproduction time and materials cost has caused management everywhere to reappraise the drafting techniques which for years had been adequate for other forms of intermediates.

Two circumstances of the microfilming processes demand better pencil drawings for this medium:

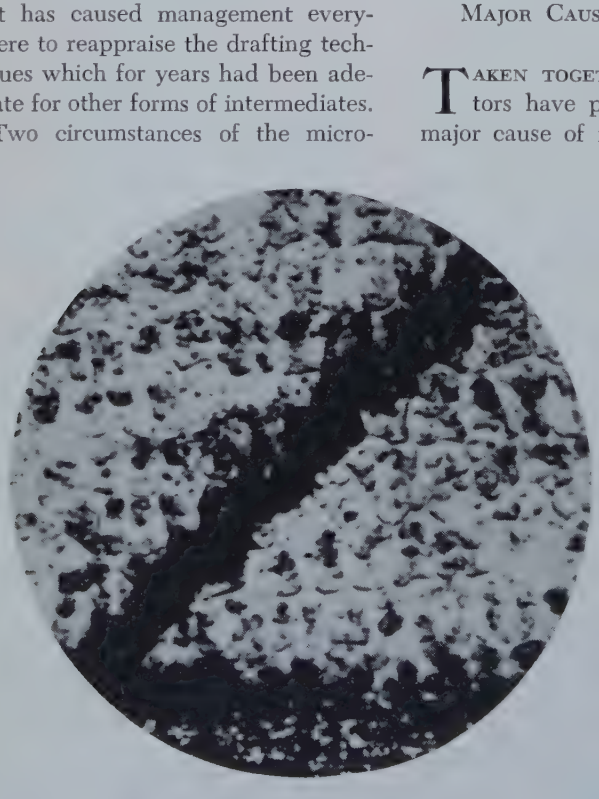
1. The camera operator dependent upon contrast for his effects is more at the mercy of the draftsman than was the contact-print maker, who was dependent upon opacity of lines for his effects;
2. Faster handling of microfilm in aperture cards has made possible faster and more critical inspection at a rate of up to ten times as fast as with other intermediates.

MAJOR CAUSES OF REJECTION

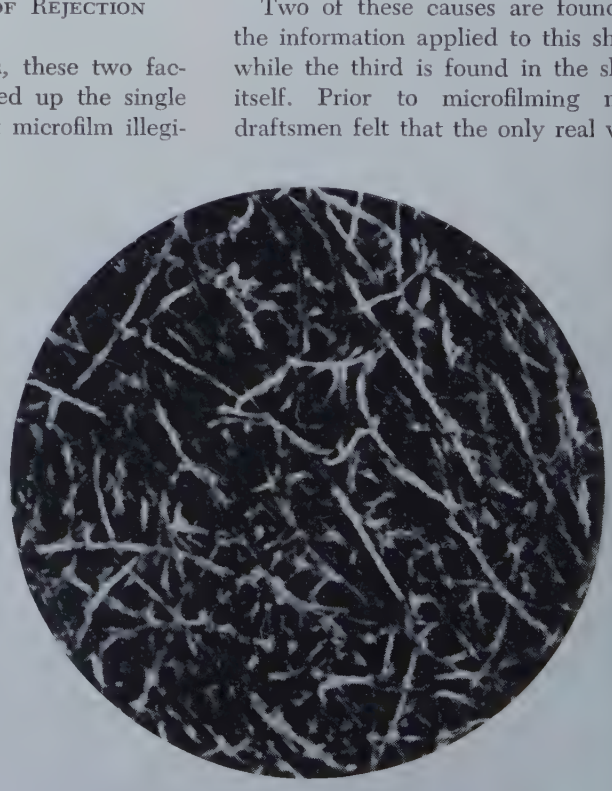
TAKEN TOGETHER, these two factors have pointed up the single major cause of most microfilm illegibility: lack of uniformity of contrast (or density) on the original drawing. This in turn was seen to be caused by:

1. The use of widely varying materials of unequal density on the same drawing (stamp pad, typewriter, pencil or ink);
2. The use of widely varying techniques in applying information to the sheet, using similar materials;
3. The use of varying housekeeping practices resulting in deleterious effects upon background density.

Two of these causes are found in the information applied to this sheet, while the third is found in the sheet itself. Prior to microfilming most draftsmen felt that the only real vari-



Film structure magnified 25 times.



Paper structure magnified 25 times.

able which could affect prints was in the line they laid down. But in microfilming both the lines and the sheet worked on are variables, inter-related by the eye of the camera dependent for its sight upon the difference between light and dark. Because of this microfilm images can seldom be better than the original drawing. Our research has shown that certain techniques of drawing, if followed, can noticeably improve the quality of microfilm.

Recommended Pencil Techniques

Basically, any pencil usage that gives lines of uneven weight, causes "spreading" of lines thru excessive point wear, changes the ability of the sheet surface to accept pencil work, or changes the background density of the sheet drawn upon, is to be avoided.

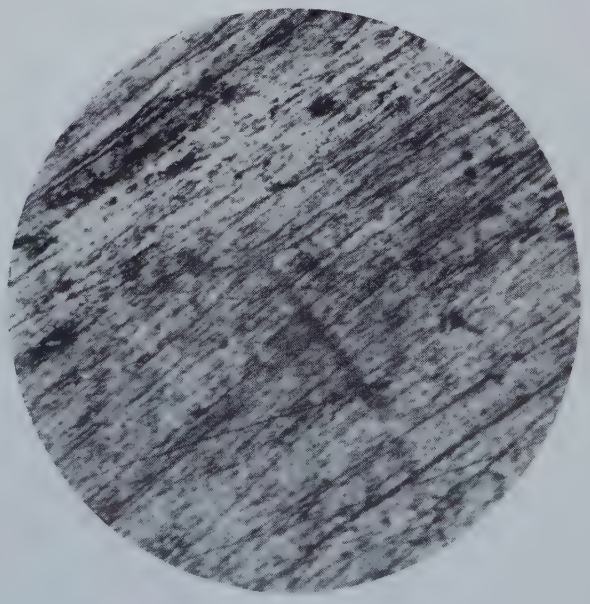
The following pencil practices have been tested, and are recommended for improvement of microfilm qualities:

1. Rotate the Pencil. Elementary as it may seem, the practice of rotating the pencil has been seriously neglected. Rotation gives a constant point to the pencil and a dense core to the line, lessening feathering at the edges of the line. Any line laid down by rotation is stronger than a line laid down flatly because the direction of the particles will not merely parallel the direction of the lines. Odd-shaped lead holders or the excessively large diameters of plastic or other leads tend to discourage rotation.
2. Maintain a Constant Angle of Pencil to Sheet. As shown in the photo both tracing paper and tracing film have structures that allow variation in line depth. The angle of the pencil, together with the pressure exerted, can place the lines at different depths, resulting in a lack of uniformity. A constant pressure and a constant angle assure uniform density, while fast-wearing leads which necessitate angle changes will cause unevenness.
3. Hold to a Minimum Letter Height of ⅛". This size is necessary (5/16" is even better) to keep looped letters from filling in and intersecting lines from "cobwebbing." Uniformity of slant, style and spacing is equally important, as is the ability of the pencil to keep its point within these close tolerances.
4. Use a Minimum Number of Different Pencil Degrees on a Single Drawing. The gradations of grayness found in different degrees of pencils can affect contrast. More than two or three degrees on a single drawing will result in some weak line images.
5. Avoid Pencils Which Wear Quickly. The use of 100% plastic leads, or softer degrees of graphite leads, may result in excessive wear, which will cause lines to widen, resulting in weak lines and lines which "spread" too close to one another. Reduction to microfilm size will then "muddy" these lines into one another. Excessive repointing also causes noticeable changes in line and letter density.
6. Use Pencils Which Erase Easily. Each time a line must be erased some disarrangement of the "tooth" of the material is caused. The more the tooth is changed, the greater will be the difference in the line redrafted over the erasure. The camera will pick this up. Very hard graphite pencils, or plastic pencils which are difficult to erase, will cause line faults in re-drafting. Even a gentle eras-

Free Poster

These nine techniques are available in poster form for display in drafting rooms. For your free copy of this poster write: Ernest M. Raasch, Pencil Sales Div., The Joseph Dixon Crucible Co., Jersey City 3, N. J.

Pencil line on film before erasing.



Film surface after erasure.

ure on tracing film, as shown in the photo, will result in some matte damage.

7. Use Erasers and Techniques Which Erase Gently. Harshly abrasive erasers heighten tooth damage, and excessive pressure and speed will cause heat which further disarranges the surface. If an erasure changes the thickness of the sheet, this will result in a change in background density and will show up on the microfilm as a "halo" which can cause illegibility. Erasing at right angles to a line will better distribute eraser damage.

8. Protect Lines and Lettering. Any practice which may reduce line density should be avoided. Excessive use of cleaning powder, the washing of tracings or the abrasion of sheets caused by stacking, will pose serious threats to density. Density losses of up to 30% from these practices are common.

9. Protect the Sheet Surface. Any accumulation of surface dust, ashes or newsprint on the surface of the sheet will lower contrast. Tracings prepared for microfilming should be covered each night, and if large, those portions not actually being worked on should be covered at all times. Frequent brushings, good housekeeping and neatness will benefit in superior clarity.

The foregoing techniques are already in use in many drafting rooms, and most are common-sense procedure. But the critical eye of the microfilm camera will increasingly demand that all of these techniques be followed to insure high quality microfilm images. Firms that have suffered excessive rejections of microfilm negatives have found most of the non-camera difficulties to be in these areas. Check your practices. You may save yourself needless rejections.

The Author

Ernest M. Raasch is Marketing Manager, Pencil Sales Division, The Joseph Dixon Crucible Company, Jersey City 3, N. J.

STANDARDS FOR MICROFILM

The application of microfilm techniques to the engineering drawing field puts increased emphasis on the need for further standardization

by Carl E. Nelson

Although microfilm was born over a hundred years ago, its age as an industry is only about 30 years. In the last two or three years some major advances toward a basis for industry-wide standards have been achieved. Where wide differences of philosophy existed, there has been a climate of desire for reaching a common ground. Where equipment designs had differed widely, basic requirements reflecting a better view of the needs of industry are bringing design standards closer together. This portends an accelerated activity for ASA Committee PH5 in reducing more and more of these areas of agreement to American Standards.

American Standards

While the initial large surge of usage of microfilm has been in government departments, industry use is now predominating, and the growth of industry use appears to be just beginning. This places great emphasis on getting approved American Standards as rapidly as possible so manufacturers can proceed with confidence to provide better tools and users can plan microfilm systems with assurance.

There are presently on the books American Standards affecting microfilm and covering the following areas:

PH1.25 - 1956 Specifications for Safety Photographic Film.

PH1.28 - 1957 Specifications for Photographic Films for Permanent Records

PH2.19 - 1959 Diffuse Transmission Density

PH4.8 - 1958 Method for Determining the Thiosulfate Content of Processed Black - and - White Photographic Film and Plates

PH4.20 - 1958 Photographic Filing Envelopes for Storing Processed Photographic Films, Plates, and Papers.

PH5.1 - 1959 Specifications for Microfilm Readers for 16mm. and 35-mm. Film on Reels

PH5.2 - 1957 Dimensions for Paper Sheets for Photo-Reproduction of Documents

PH5.3 - 1958 Specifications for 16mm. and 35mm. Microfilm on Reels or in Strips

PH5.4 - 1957 Practice for Storage of Microfilm

Z38.7.17-1946 Reels for Processed Microfilm

Needed Standards

There are urgently needed standards to cover a number of other areas which are now ripe for such standards. While the need seems most pressing in the application of microfilm to engineering drawings, similar standards are required for all applications of microfilm. Areas requiring standardization are:

1. **Quality of Microfilm**—In subcommittee PH5.1 a great effort is being expended to establish the quality requirements of microfilm. This effort will result particularly in standards for resolution and density and their application to the variations of different systems.
2. **Materials**—Involved here are, for example, requirements for the different films used, such as silver emulsion, diazo, and thermally developed film. Other areas may include chemicals, development formulas, and methods.
3. **Hardware**—In this field there is now only a standard for readers for roll film. Greatly needed are standards for cameras, readers for card - mounted film, reader-printers, enlarger-printers, film processors, card-to-card and roll-to - roll duplicators, mounters which mount a frame of microfilm into an apertured card, certain testing equipment, and other tools of the industry.
4. **Drafting**—While very measurable progress has been made in the field of drafting standards generally, microfilm has imposed some new requirements. A joint group consisting of representation from ASA Sectional Committees Y14 and PH5 has been constituted to examine this area. Drafting standards form the basis from which many other standards grow. They also control the final readability of microfilm.
5. **Methods of Practice**—This area is one which must be approached somewhat more cautiously, since resultant standards could be more restrictive than helpful. However, there are many things which can be standardized and from which can come substantial benefits. For example, the DoD specification standardizes reductions of 16, 20, 24 and 30 for drawings. Industry is moving in this same direction. Such standards permit manufacturers to design equipment with assurance that it will meet the users' needs.

This paper was presented by Mr. Nelson before the Eleventh National Conference on Standards of the American Standards Association.

Another typical item is the size and placement of the aperture in the aperture card and the centering of the film within the aperture. Manufacturers cannot successfully meet the demands of the market until general agreement is reached on items of practice such as these.

Bell System Standards

Within the Bell System there was early recognition of the need for standards in the microfilm field. A concentrated and co-operative development effort has led to system-wide standards. Wherever American Standards were available, these have been used. However, in the areas just mentioned where no American Standards are yet available, new standards have been developed for Bell System use. Quality and materials standards very closely parallel the new Department of Defense specifications. Extensive tests of available hardware have been very informative as to those which can produce microfilm or microfilm copy to meet the quality standards. Basic to film quality standards and standards for methods and practice are certain drafting standards. For example, the height of a letter on an original drawing influences how much it can be reduced on microfilm. In turn, the magnitude of reduction determines the magnification required on a reader, to make an image readable, or on a printer which makes an enlarged print from the microfilm. Thickness and density of lines and general condition of a drawing play an important part in making quality microfilm. Standards for these and many other drafting areas affecting microfilm have been established.

It should be mentioned here also that much progress has been made toward uniform drafting practice due to the excellent co-operation between representatives of industry and government which resulted in engineering drawing specification MIL-D-70327 and the related military drafting standards in the MIL-STD series.

With respect to standards for methods and practice the Bell System is aware that much of this area must be tailored to the individual needs of companies and government agencies. However, there also is much common ground where it is to the advantage of everyone to have common standards. An honest effort is being made in this area to shape Bell System standards as nearly as practicable to the common needs of both industry and government.

Microfilm Standards

While these areas where standards effort will be placed appear to be prompted by the present great interest in applying microfilm techniques to the engineering drawing field, the same need is equally pressing in other applications of microfilm. It is said that our country has millions of feet of 16mm. microfilm of page size documents, but no one knows whether it is of a quality sufficient to guarantee usefulness should it be called upon to produce hard copy. The importance of standards is as great in this field as in the 35mm. film field.

The Author

Carl E. Nelson heads the Bell Telephone Laboratories department of research in engineering methods and is chairman of Bell's Reproduction Committee. The National Microfilm Association elected him as the first industrial member to its board of directors.

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Two-Process Printer

A new two-process printer requiring no darkroom has recently been developed for use in making tranparencies for overhead projection. Ozalid Division, General Analine and Film Corp., 68 Corliss Lane, Johnson City, N. Y., calls its product Projecto-Printer 40, suggests it for use in education, military, sales training and promotion especially. Simple to operate and portable, it can be used for in-the-field production of transparencies. Two reproduction processes are employed: dry developing diazo method and the reflex photocopy method. All developer chemicals are contained in a plastic bag attached inside the machine to simplify filling, draining, and storing processing solutions. Projecto-Printer 40 weighs 35 lbs., is 12½" wide, 15¾" long, has storage space for developer supplies and 100 sheets of sensitized material. Operation requires 110 volt AC.

(For additional information regarding the new products described here, contact the manufacturer directly. Complete addresses are included.)

Precision Instruments

The U. S. Blue Print Paper Co., 111 N. Wacker Drive, Chicago 6, Ill., has announced its appointment as distributor for E. O. Richter & Co. precision drawing instruments. Quality and craftsmanship standards of Richter products are to be maintained while the pricing of the line will now be competitive. The instruments are plated with a hard, non-tarnish finish on solid German silver. New refinement is a patented arrestor pin in the compass head to prevent any damage to straightening device when opened to full width.

Ammonia Gas System

A new anhydrous ammonia gas system for use with all dry diazo equipment has just been announced by Copy-mation, Inc., Dept. AM, 5650 North Western Ave., Chicago, Ill. The new Ammo-Matic system is available on all the company's whiteprinters and can easily be installed on other makes, old and new, of dry diazo equipment. Tests indicate that Ammo-Matic considerably improves print development and effects savings up to 50%. Positive control of ammonia flow gives optimum print development.

Precision Templates

A series of templates corrected to .017 inches to allow for Rapidograph Technical Fountain Pen No. "00" and the Koh-I-Noor Drawing Pencil has been announced by Koh-I-Noor, Inc., Bloomsbury, N. J. Templates are orange, have designating data engraved for permanence, and are packaged on cardboard in a transparent plastic container for ease in selection. Series includes Square, Circle, Triangle, Screw Head, Tangent Curved, and other designs. Complete data is available from company.

Speedier Whiteprinter

A new speed control dial has been added to the Blu-Ray portable rotary diazo whiteprinter manufactured by Reproduction Engineering Corp., 680 Plains Road, Essex, Conn. A faster motor accelerates the speed of the machine 50%, enables it to print at a rate of from 4″ to 6′ per minute. Wider speed range makes possible handling of slow sepia paper or new faster printing papers. The Blu-Ray copies any typed, written, drawn, or printed material on any translucent surface up to 42″ wide and of any length at a cost of less than 2¢ a square foot.

Quality Tracing Vellum

A new transparentizing resin has been paired with high grade rag paper to produce a new high quality tracing vellum. The manufacturer, Ozalid Division of General Analine and Film Corp., 50 Corliss Lane, Johnson City, N. Y., offers it as a highly durable tracing paper for engineering, architectural and map drawings, and for type-on masters for whiteprint, letterpress, or offset reproduction. It is available in brilliant white with a faint green tint to prevent glare. It has a slightly textured surface to insure good pencil take. The surface will also accept drawing ink without skipping, feathering or spreading. Ink lines may be erased at least three times and pencil lines ten times without damage to the drafting surface. Ozatrace comes in 16-lb. weight, in 30″, 36″, and 42″ rolls and in all cut sheet sizes. According to Ozalid, the new vellum exceeds in tear strength the Federal specifications for transparentized permanent tracing papers.

Quick-Change Bow Compass

A new model quick-change bow compass with a novel double adjustment is now being marketed by the Omicron Co., Dept. F, P.O. Box 907, Glendale, Calif. New compass has no threads, utilizes instead a smooth, hardened rod on which a hardened canting lever actuates with a positive lock in any position and slow motion adjustment when rod is turned. Rod-lever action is designed to improve with use, never wear out. Capacity is over 6″ radius. Priced at $6.50.

New Literature

Transcopy Photocopy Products are described in a 4-page combination brochure and swatch book. Product descriptions and uses for over 25 different weights and types of negative and positive papers and films are outlined in the booklet which can be obtained by writing to Transcopy, Inc., Anken Chemical & Film Corp., Newton, N. J.

A Tissue-Thin Natural Tracing Paper is described in a free folder available from Keuffel & Esser Co., Third and Adams Streets, Hoboken, N. J. The folder points out that Banknote, the new paper, is made on one of the few Foudrinier paper machines still employed that runs a "top jacket."

The M4 Automatic Blueprinting Machine, manufactured by Paragon-Revolute Corp., 77 South Ave., Rochester 4, N. Y., is described and pictured in operation in a new 24-page booklet. Various aspects of the Revolute M4 including construction, cleaning, chemical treatment, electrical drying, and floor space savings are dealt with. The booklet is available free by writing to the above address.

Captive Shop Precision Microfilm, an 8-page illustrated booklet by J. W. Soman, describes the method of running the I.B.M. in-plant microfilm system. Copies of the booklet are available free by writing Dept. SO-262, Microfilm Products, Minnesota Mining & Manufacturing Co., 900 Bush Ave., St. Paul 6, Minn. The author details the steps and procedures in producing precision microfilm as a captive shop operation, also discusses I.B.M.'s present microfilm techniques and future improvements including the making of drawings by computer and their conversion directly from magnetic tape to microfilm.

Complete Photocopy Line is described in a 4-page, 2-color, brochure just issued by Peerless Photo Products, Inc., Shoreham, L. I., N. Y. The 33 industrial photocopy products produced by the company are described in detail, and three charts give suggested uses for the various articles. Material on slow contact, standard contact, and projection speed papers and cloths is included. Copies of the brochure are available by writing to the company at the address above.

Architects and Engineers Scales are the subject of a new 2-page bulletin, the latest in a series of entirely new catalogs and bulletins by the manufacturer of drafting equipment. Construction features, classifications of scales, and size ranges are described in Catalog 60-AE, which may be obtained by writing V. & E. Manufacturing Co., 766 South Fair Oaks Ave., Pasadena, Calif.

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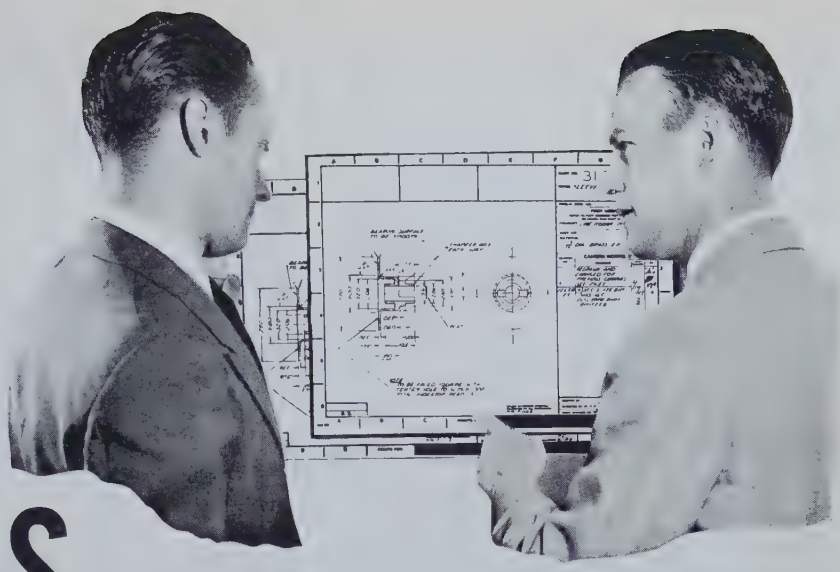

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"The Measure of Man" is the title of a new publication of the Whitney Library of Design, 18 East 50th St., N. Y., N. Y. Assembled by Henry Dreyfuss, the publication consists of a portfolio containing sixteen charts, a booklet, and two full-size charts of the human body containing a vast amount of information on human factors. Facts include how large and how small people are, how far people can see, reach, step, etc., and a multitude of facts intended to be useful to designers of buildings, furniture, appliances, machinery, clothes. This assemblage of human factors in design is available from the publisher at $4.95 a copy.

Precision Hand Tools for Industry, a catalog and price list with illustrations, is available free from Handicraft Tools, Inc., a division of X-Acto, Inc., 48-41 Van Dam St., Long Island City 1, N. Y. The catalog includes a list of some of the applications of these precision tools ascertained in an industry on-the-job survey. Copies of the survey also available on request from the company at the above address.

New Doric Lettering Set, designed for professional, business, school, and home use, is completely described in a 2-page bulletin from Keuffel & Esser Co., Third and Adams Streets, Hoboken, N. J. The folder illustrates with sample lettering how the new 8935 Doric Lettering Set reproduces letters and numbers, vertically and slanted, in capitals and lower case, pencil or ink, and in three sizes, .100, .140, and .240 inches. Literature is available by writing to the above address.

Tracing and Drawing Media is the subject of a 16-page brochure, which gives details of tracing cloth, paper, films, Federal aid and plan-profit sheets, logarithmic and special purpose sheets and a number of other related products. Copies of this detailed brochure are available from the manufacturer free. Write to Frederick Post Co., Box 803, Chicago 90, Ill.

Vemco Instrument Cases, a catalog containing information on the various combinations of drawing instruments and cases available and illustrations of same, is now in print. Requests for copies of Catalog 60-IC and the price lists should be sent to V. & E. Manufacturing Co., 7666 South Fair Oaks Ave., Pasadena, Calif.

Applied Graphics Catalog PSM-60, lists all the standard stock items manufactured by Applied Graphic Corp., Glenwood Landing, L. I., N. Y. Prices are given for a wide range of pressure sensitive drafting materials and related objects. Copies of the catalog are available free by writing to the above address.

Any-Angle Drafting Machine is the subject of a 4-page illustrated brochure issued by Keuffel & Esser Co., Adams and Third Streets, Hoboken, N. J. The pamphlet gives complete details on the operational features of the Paragon Auto-Flow, a versatile drafting machine which permits a draftsman to work at any board angle suited to him, with scales which lock in place to eliminate drift. Copies are available by writing to the above address.

New Coordinated Line of products for drawing on drafting film is the subject of a 4-page pamphlet by Koh-I-Noor, Inc., Bloomsbury, N. J. Products described as especially designed for use on drafting film include drafting leads and pencils, erasers, lead holders, and technical fountain pens. Copies of the pamphlet are available free on request from the company at the address above.

Low Cost Reproduction is the theme of a new 12-page pamphlet put out by Charles Bruning Co., Inc., Mount Prospect, Ill., and available free on request. The Bruning Copyflex process is described as a high-quality, low-cost reproduction method for use in engineering, drafting, and architecture. Included are illustrations of a complete range of models and sizes made by the company, with details of dimensions and special features.

Metric Conversion Calculators, which provide instant conversion calculations of Metric and English factors, are available from Kelm Manufacturing Co., Route 2, Coloma, Mich., at $2 each, and $1.60 each in quantities of five or more. The calculators come in durable plastic cases, 3⅜" by 8½". A 2-page bulletin describing the finer points and illustrating the calculator is also available free at the above address.

(Copies of the literature reviewed can be obtained directly from the manufacturer or publisher. Complete addresses are included.)

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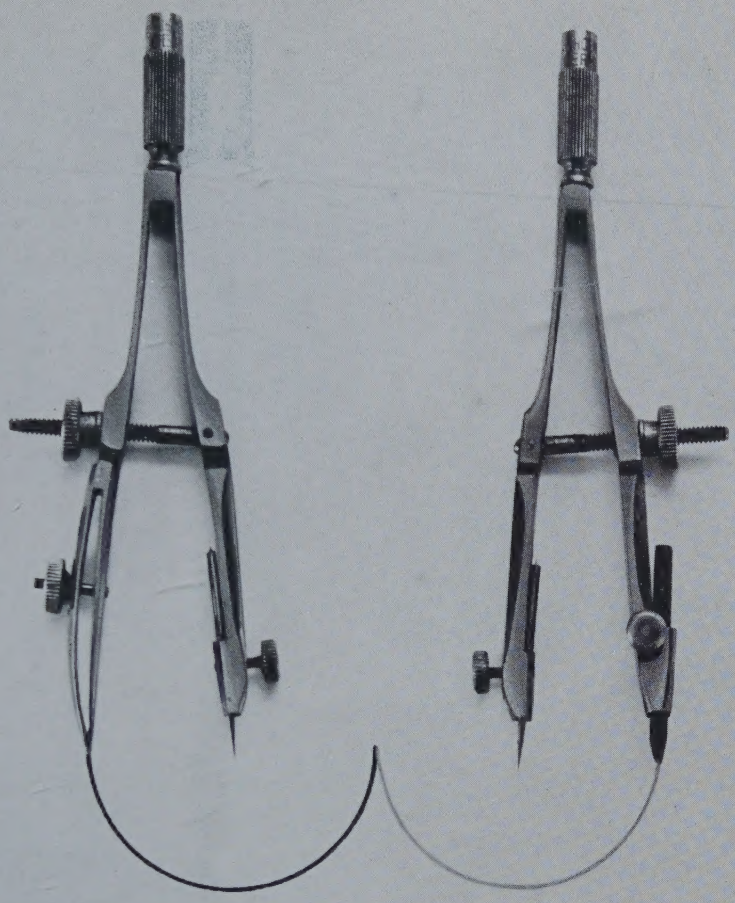

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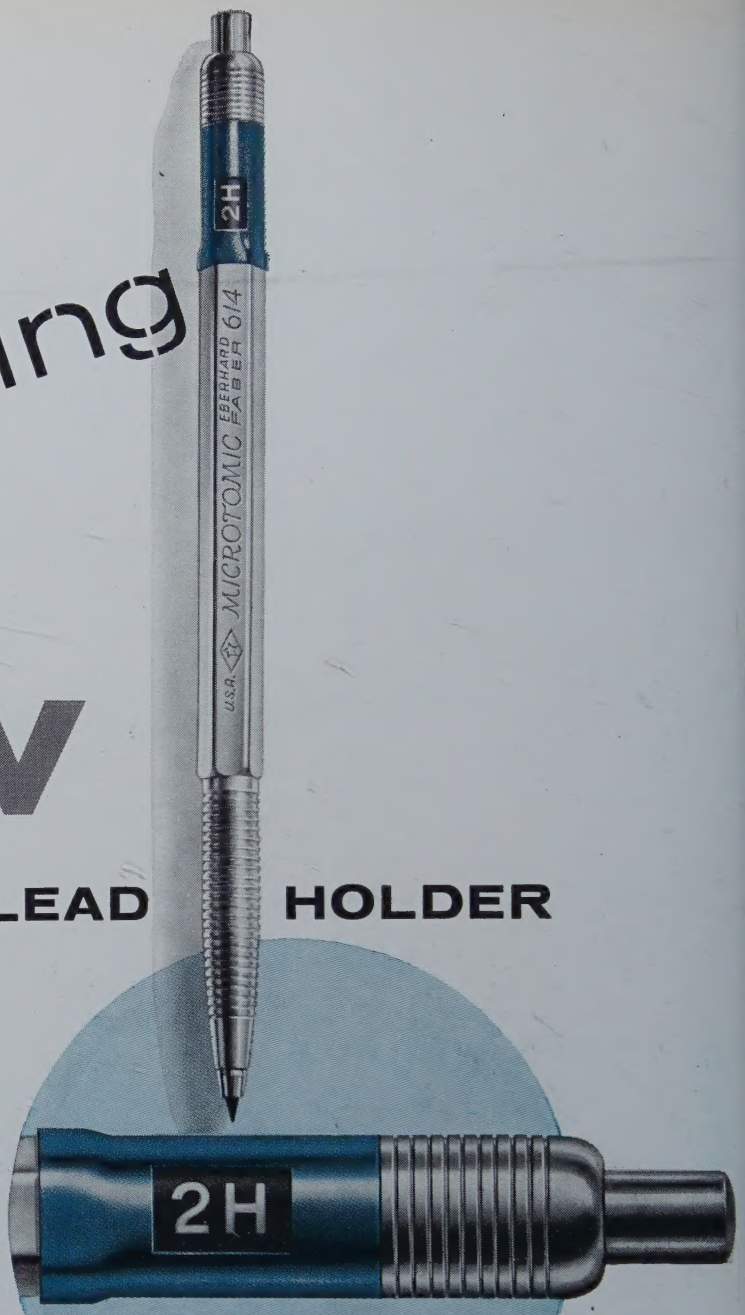

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